NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

STRUCTURE FOR WATER CONTROL

(No.)

CODE 587

DEFINITION

A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation or measures water.

PURPOSE

The practice may be applied as a management component of a water management system to control the stage, discharge, distribution, delivery or direction of water flow.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies wherever a permanent structure is needed as an integral part of a water-control system to serve one or more of the following functions:

- Convey water from one elevation to a lower elevation within, to or from a water conveyance system such as a ditch, channel, canal or pipeline designed to operate under open channel conditions. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes and stilling basins.
- Control the elevation of water in drainage or irrigation ditches. Typical structures: checks, flashboard risers and check dams.
- Control the division or measurement of irrigation water. Typical structures: division boxes and water measurement devices.
- Keep trash, debris or weed seeds from entering pipelines. Typical structure: debris screen.
- Control the direction of channel flow resulting from high water or back-flow from flooding. Typical structures: tide and water management gates.
- Control the water table level, remove surface or subsurface water from adjoining land, flood land for frost protection or manage water levels for wildlife or recreation. Typical structures: water level control structures, flashboard risers, pipe drop inlets and box inlets.
- Convey water over, under or along a ditch, canal, road, railroad or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons and long span pipes.
- Modify water flow to provide habitat for fish, wildlife and other aquatic animals. Typical structures: chutes, cold water release structures and flashboard risers.
- Provide silt management in ditches or canals. Typical structure: sluice.
- Supplement a resource management system on land where organic waste or commercial fertilizer is applied.
- Create, restore or enhance wetland hydrology.

CRITERIA

General Criteria Applicable to All Purposes

Planned work shall be in conformance with all federal, state, and local laws, rules and regulations. These include but are not limited to floodplains, utilities, and Oklahoma Water Resources Board criteria.

The criteria for the design of components not addressed in Oklahoma NRCS practice standards shall be consistent with sound engineering principles.

All Structures shall complement an approved plan. Structural components shall meet an

approved standard drawing or be designed and approved by an engineer with the appropriate authority.

Structures shall not be installed that have an adverse effect on septic filter fields.

Embankments. Earthen embankments installed as the Structure for Water Control or used in conjunction with principal spillways or other water control structures shall comply with the criteria below.

The height of the embankment shall not exceed 8 feet (settled) as measured from the auxiliary (emergency) spillway crest to the low point along the centerline of the embankment (Effective Height). Structures exceeding 8 feet in effective height exceed criteria for this standard and shall meet criteria found in the Oklahoma NRCS Pond (378) or Grade Stabilization Structure (410) standards, as applicable.

For embankments installed in floodplains or where the potential exists for overtopping, the top width shall be no less than 10 feet and the side slopes of the embankment shall be no steeper than 4:1 (Horizontal to Vertical). For upland sites or sites not in danger of overtopping, the minimum top width and side slopes shall be as specified in the Oklahoma NRCS Pond (378) standard.

If used as a public road, the top width shall be no less than 16 feet for a one-way traffic and 26 feet for two-way traffic. Side slopes shall be no steeper than 3:1.

Embankments shall be a minimum of 0.5 feet higher over and around any conduit that is installed through the embankment. The increased height over the conduit shall blend smoothly into the surrounding embankment crown.

Borrow areas should be random and meander throughout the wetland unit. Cut slopes for borrow areas shall be no steeper than 3:1. Borrow may be obtained from the backside of the embankment if determined by an engineer as appropriate for the site conditions. Unless otherwise approved by the engineer, borrow areas shall not exceed 3 feet in depth from natural ground.

Flow-over embankments may be used in select cases where flood flows are known to inundate the site. Criteria for flow-over embankments shall be determined on a case by case basis. As a minimum, the slope on which water will flow shall be no steeper than 10:1 and the top width of the embankment shall be no less than 20 feet unless other protective measures are employed. Flow-over embankments greater than 3 feet in height require the approval of the State Conservation Engineer.

Principal Spillway. Principal spillways shall be designed on a minimum of a flood routed 2-year, 24-hour storm. Flood routing will be by approved flood routing procedures. The principal spillway may also act as the water control structure.

The Cypress Creek Formula ($Q=CM^{5/6}$) may be used to estimate peak discharge provided all criteria for its use can be met. Criteria for the Cypress Creek Formula can be found in National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water Management (Drainage), Subchapter B, 650.1410. If used, the C factor for Eastern Oklahoma (east of Interstate 35) will be 45 and the C factor for Western Oklahoma (west of Interstate 35) will be 33.

The conduit used for the spillway or water control structure may be a metal or plastic barrel and riser or a concrete box.

Concrete box culverts shall be poured-in-place, have a minimum bottom width of 45 inches, and have removable lids for maintenance. The height of the box is dependent on maximum water levels but shall not exceed 4 feet. Box culverts shall be designed for weir flow into the box.

All conduits must meet a standard drawing or be approved by the engineer, prior to use. Barrels connected to an inline riser do not require an anti-seep collar; however, all other barrels shall be equipped with at least one anti-seep collar. Additional anti-seep collars may be needed if the structure warrants based on criteria found in the Oklahoma NRCS Pond (378) standard. The anti-seep collar may be shortened from the top to prevent protrusion from the embankment. In no case will the anti-seep collar be shortened below the spring-line of the pipe. The minimum depth of cover over an anti-seep collar shall be 1 foot. Box culverts shall be equipped with a cut-off wall as specified on the drawings.

All water control structures, regardless of type, should be constructed such that the maximum design water level cannot be exceeded. If such a feature is not feasible, the maximum design water level shall be clearly marked on the structure.

Auxiliary Spillways. Auxiliary spillways will need to pass either the routed 10, 25, or 50 year – 24 hour storm depending on criteria found in Table 2 of the Oklahoma NRCS Pond (378) standard. The drainage area for routing shall be based on the direct runoff into the wetland, excluding out-of-bank flow.

A minimum of a 10-foot wide auxiliary spillway shall be provided on all embankments. The minimum elevation between the principal spillway and the crest of the auxiliary spillway shall be as required for the desired conduit capacity, but not less than 0.5 feet. The top of the embankment shall be no less than the design depth of flow in the auxiliary spillway plus 0.5 feet.

When the structure for water control is installed along a creek or stream channel, the auxiliary spillway shall be located at the downstream end of the structure.

An auxiliary spillway may be planned on fill material provided the following criteria are met:

Aux. Spill. Crest *	Min. Exit Slope	Type of Cover
0.5' to 1.9'	10:1	Mulch Sod (Bermuda)
2.0' to 3.0'	4:1	Solid Sod (Bermuda)
> 3.0'	4:1	Turf Reinforced Mat seeded with Fescue or Bermuda

* Crest above natural ground. Does not apply to fill areas less than 0.5 feet.

Water Control Structures. Where an adequate auxiliary spillway condition exists or can be established, as approved by an engineer, a water control structure may be installed for the sole purpose of water level control without a significant principal spillway capacity.

If the design water level upstream of the water control structure is such that water will be temporarily impounded or diverted onto adjacent landowners, an installation permit will be required as a minimum. The design water level is the elevation of the auxiliary spillway plus the design depth of flow in the auxiliary spillway.

Vegetation. Vegetation complying with Oklahoma NRCS Critical Area Planting (342) standard shall be established on all disturbed earth surfaces. The structure shall be fenced, if necessary, to protect the vegetation.

Additional Criteria for Controlling the Elevation of Water in a Drainage or Irrigation Ditch

Tailwater Diversion Systems. Tailwater diversion structures shall be designed to capture tailwater runoff as part of a conservation irrigation system. The size of the diversion structure is determined by the contributing irrigated field. Measures must be incorporated into the design to safely bypass storm water runoff in excess of tailwater runoff volumes.

The location of the diversion structure shall be such that impacts to natural drainage are minimized. Installations shall incorporate settling basins to limit sedimentation of the receiving tailwater pit.

Installations located on lands in the right-of-way of a governmental entity (i.e. county, irrigation district, etc.) must have an installation permit approved by that governmental entity.

Additional Criteria for Creating, Restoring, or Enhancing Wetland Hydrology

Availability of Water. Sites shall be designed such that under normal climatic conditions, water will be available to meet the wildlife needs and landowner objectives. Local knowledge and experience in an area may be the best gauge for determining water availability. For sites in floodplains, an estimate of the number of times the creek, stream, river; etc. spills into the floodplain may suffice as a determination of water availability. For sites dependent on rainfall runoff, drainage areas must be sufficient for the planned amount of storage. For runoff dependent sites, storage volumes at permanent pool elevation should not exceed the 1-year storm (reduced curve number) runoff volume by more than 15 percent for sites west of Interstate 35 and 50 percent for sites east of Interstate 35.

Embankments. A berm (an area between the toe of the embankment and the cut slope of the

borrow area) shall be used for all embankments. The berm shall be a minimum of 10 feet wide.

Principal Spillway. Where metal barrels and risers are used on perpetual or 30-year easement restoration projects, the structures shall be treated with Aluminized Type II or other approved protective coating.

Guards. Trash, debris, or beaver guards shall be installed on all inlets. Rodent guards shall be installed on outlet pipes. All guards shall meet approved drawings, be included on the Pre-approved Structures, Components, and Appurtenances list, or be approved by the engineer, prior to use.

Vegetation. Embankments, especially those located in a floodplain or where the potential exists for overtopping, shall be planted to an erosion control type vegetation (i.e. Bermuda or Fescue). Other areas within the wetland unit may be vegetated with native species.

Where soil, climate or site specific conditions preclude establishing permanent vegetation, a temporary cover shall be established according to the Oklahoma NRCS Cover Crop (340) standard or other approved protective means such as mulches or gravels, shall be used.

CONSIDERATIONS

When planning, designing, and installing this practice, the following items should be considered:

- Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
- Effects on downstream flows or aquifers that would affect other water uses or users.
- Effects on the field water table to ensure that it will provide a suitable rooting depth for the anticipated crop.
- Potential use for irrigation management to conserve water.
- Effect of construction on aquatic life.
- Effects on stream system channel morphology and stability as it relates to erosion and the movement of sediment, solutes, and sediment-attached substances carried by runoff.
- Effects on the movement of dissolved substances below the root zone and to ground water.
- Effects of field water table on salt content in the root zone.
- Short term and construction-related effects of this practice on the quality of downstream water.
- Effects of water level control on the temperatures of downstream waters and their effects on aquatic and wildlife communities.
- Effects on wetlands or water-related wildlife habitats.
- Effects on the turbidity of downstream water resources.
- Existence of cultural resources in the project area and any project impacts on such resources.
- Conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

Design alternatives presented to the client should address economics, ecological concerns, and acceptable level of risk for design criteria as it relates to hazards to life or property.

Additionally, for wetland structures these items should be considered:

- In floodplains, consider auxiliary spillways (cut or natural) as wide as practical for added structure protection.
- Where moist soil management is likely to be practiced, consider installing ramps off of embankments and across borrow areas to provide vehicular access to the wetland unit. Also consider obtaining borrow from the backside of the embankment to maximize moist soil acreage.
- For long embankments used for access to water control structures, consider installing turn-a-rounds. A minimum of one turn-a-

round should be installed for each water control structure. Additional turn-a-rounds should be considered for each 1500 feet of embankment. Turn-a-rounds should blend into the diversity of the embankment layout.

- Consider termination of the borrow area along some reaches of the embankment to add diversity to the topography of the site.
- Consider raising embankments and water control structures to allow for sedimentation unless such heights are limited by offsite conditions.
- Where site conditions allow, consider embankments and water control structures that will permit greater water depths for control of undesirable vegetation by flooding.
- To increase the life span of metal pipe conduits, consider Aluminized Type II or polymer coated pipe.
- Where debris or beaver activity could clog structures, consider a minimum barrel diameter of 18 inches.
- If water depths along the embankment will not support vegetation and wave damage can be expected, consider additional freeboard to account for wave heights. Also consider a sloping berm to provide shallower water depths so that vegetation such as Kanlow Switch Grass can be established.

PLANS AND SPECIFICATIONS

Plans and specifications for installing structures for water control shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

The plan shall specify the location, grades, quantities, dimensions, materials, and hydraulic and structural requirements for the individual structure. Provisions must be made for necessary maintenance. Care must be used to protect the surrounding visual resources. If watercourse fisheries are important, special precautions or design features may be needed to facilitate continuation of fish migrations.

OPERATION AND MAINTENANCE

An operation and management plan shall be provided to and reviewed with the land manager. The plan shall be site specific and include but not be limited to the following: Structures will be checked and necessary maintenance, including removal of debris, shall be performed after major storms and at least semi-annually. Water level management and timing shall be adequately described wherever applicable.

REFERENCES

Oklahoma NRCS Conservation Practice Standards:

378 – Pond
410 – Grade Stabilization Structure
342 – Critical Area Planting
340 – Cover Crop
447 – Irrigation System, Tailwater Recovery
657 – Wetland Restoration
658 – Wetland Creation
659 – Wetland Enhancement

National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water Management (Drainage)

National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 13, Wetland Restoration, Enhancement, or Creation

Oklahoma Engineering Forms and Standard Drawings Handbook

Oklahoma Water Resources Board Rule

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE GENERAL SPECIFICATIONS

STRUCTURE FOR WATER CONTROL

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GENERAL SPECIFICATIONS

Unless otherwise specified, specifications for this practice shall meet or exceed the Oklahoma NRCS Pond (378) standard.

Plastic Components. Corrugated polyethylene (PE) pipe may be used as conduits where the design head on the conduit is less than 4 feet. Prefabricated PE water control structures must be included on the Pre-approved Structures, Components, and Appurtenances list or be approved by the engineer, prior to use.

Turf Reinforcement Matting (TRM). Turf reinforcement matting shall be installed according to manufacturer's recommendations and extend completely to the downstream end of the auxiliary spillway.

Shrinkage and Construction Tolerances. Shrinkage will be 10% of the fill height regardless of equipment used unless otherwise specified. Top width shall be plus or minus 1 foot near water control structures. Any overbuild should blend into the shape and form of the embankment. In no case shall the top width be less than 1 foot of the design top width. Side slopes shall be plus or minus 0.5:1 of design slope near water control structures. In no case shall the side slope be less than 0.5:1 of the design side slope. Care should be taken to avoid flattening backslopes too much near fences, property boundaries, etc. The embankment height can be level provided that the maximum overbuild at the point of highest shrinkage does not exceed +0.2 feet except over water control structures. Fill over the water control structure and surrounding area should be the highest point of the embankment but blend into the finished grade of the embankment. There is no tolerance below the design height. Auxiliary spillway elevation shall be plus or minus 0.1 feet of design Principal spillway elevation shall be plus or minus 0.1 feet of design. Flow-over embankments shall have no more than 0.2 feet above design plus shrinkage and shall be plus or minus 0.1 feet end to end and side to side. Overbuild can be detrimental to restoration. Overbuilt embankments may lead to pipe length problems, doesn't blend naturally into the environment, and could create weak points in areas that are not overbuilt.

Soils Investigations. Soil investigation results including dispersion tests shall be documented as applicable on OK ENG-6 or OK ENG-12.